

PINYONS OF THE CHIHUAHUAN DESERT REGION

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In the course of preparing a chapter on the PINACEAE for a flora of the Chihuahuan Desert Region<sup>1</sup> the distribution and taxonomic rank of the pinyons of the region were found to be inadequately described. The pinyon studies relevant to the Chihuahuan Desert Flora are part of a more general investigation, begun in 1973 and still in progress, of all the pinyons (Pinus subsection Cembroides). Two taxa, hitherto of the rank of variety, require elevation to species level for reasons given below. In addition a third taxon has recently been described at the species level (Robert 1978). The superficial similarity of these three taxa, and P. cembroides sensu stricto, should not obscure their important and consistent differences.

PINUS REMOTA (Little) Bailey & Hawksworth, comb. nov.

paper-shell pinyon

Pinus cembroides Zucc. var. remota Little, Wrightia 3:183, 1966. Holotype: US, as P. cembroides var. remota, Val Verde County, Texas, 13 miles south of Loma Alta, 1 April 1963, Little & Correll 18991.

Pinus remota as defined by Little (1966) differs from Pinus cembroides Zucc. sensu stricto - henceforth referred to as Pinus cembroides - in its much thinner seed shells, needle fascicles mainly in 2's, but with some 3's and slender gray twigs. We have found several additional differences. Two of these are especially important for determination of herbarium specimens. First is the frequent presence of more than 2 resin ducts per needle, the number invariably associated with P. cembroides and with P. edulis var. edulis. P. remota has occasionally been taken to be P. edulis var. edulis in northern Mexico and west Texas because it has somewhat thicker needles in these areas than

<sup>1</sup>"A Chihuahuan Desert Flora", M. C. Johnston, compiler, in preparation at the University of Texas at Austin.

either P. remota from the Edwards Plateau population or nearby P. cembroides. Second ~~are~~ the abbreviated open fascicle sheaths. The curl-back of the fascicle sheaths, which make conspicuous rosettes around the bases of fascicles that are about a year old in the case of P. cembroides, is much less for P. remota. For the latter, the curl-back is typically of the order of 90° or less, in contrast with P. cembroides and all other pinyons (except Pinus nelsonii with persistent fascicle sheaths) for which the curl-back is typically 270° or more. This difference seems to be a consequence of weaker fascicle-sheaths for P. remota, the distal portions of which are deciduous almost as soon as curl-back begins. Significant differences in altitude are also found between P. cembroides and P. remota; the latter usually occurs at lower elevations. The main range of P. remota is in Coahuila, but it reaches parts of adjacent Nuevo León, southeastern Chihuahua and Texas (Bailey & Wendt 1979).

A particularly important feature of P. remota, not mentioned by Little, is its occurrence (near its upper elevational limit) sympatrically in west Texas with P. cembroides (near its lower elevational limit) without evidence of hybridization--a strong justification for its specific rank.

PINUS DISCOLOR Bailey & Hawksworth, stat. et nom. nov.

border pinyon

Pinus cembroides Zucc. var. bicolor Little, Phytologia 17:336, 1968. Holotype: US, as P. cembroides var. bicolor, Santa Cruz County, Arizona, Madera Canyon, Santa Rita Mountains, 20 May 1968, Little 23011 (female plant) and 23010 (male plant).

The varietal name bicolor (Little 1968) is not used, in this instance, as the specific epithet because of prior use (Pinus bicolor Maxim. ex Parl. in DC. Prod. xvi, II, 418, 1868). Pinus bicolor was a creation of Parlatores and it was from the first a synonym for a Picea, although Maximowicz himself in creating Abies (not Pinus) bicolor (Maximowicz 1866) assigned it to Abies. While Article 34 of the International Code of Botanical Nomenclature might permit us to use bicolor, Article 32, Recommendation 32c, states that "Authors should avoid adoption of a name or epithet which has been previously, but not validly, published for a different taxon." The epithet discolor which we have chosen instead preserves Little's descriptive intentions in the varietal epithet bicolor. Both refer to the usually conspicuous difference in color between the green dorsal and glaucous ventral needle surfaces.

Pinus discolor differs from P. cembroides in its lack of dorsal stomata, 2-colored needles and smaller cones (Little 1968). We have found several additional differences. Thus, P. discolor has fascicles on a given tree almost entirely in 3's, but with occasional 4's. Fascicles of 2 are significantly less frequent than 4, although similar counts in the past have reported the reverse--probably the result of including incomplete fascicles in hasty counting. Fascicles of 5 are occasionally found. In contrast, P. cembroides has fascicles of both 2 and 3 needles on the same tree. When the entire geographical distribution is sampled no marked tendency is found toward either 2 or 3. In addition, needle retention is usually longer for P. discolor (typically 4-7 years) than for P. cembroides (typically 2-5 years). Moreover, on older trees, highly distinctive bark differences have been noted. These differences are obvious on common sites where the 2 taxa occur side by side. The bark of P. discolor is somewhat thinner than that of otherwise comparable specimens of P. cembroides and consists of ragged, concave, grayish platelets of variable size and shape, typically 2-5 cm wide, with intervening, more or less longitudinal fissures, some of which exhibit a conspicuous orange to yellow color. In contrast, the bark of old trees of P. cembroides tends to exhibit thick, roughly polygonal plates of charcoal black, giving no impression of raggedness and having obvious transverse as well as longitudinal fissuring or cross-checking, and without the orange to yellow color deep in the furrows as in P. discolor. Unlike P. remota, P. discolor has seed shells as thick or even thicker than those of P. cembroides. Little confirmed the subdioecious character of P. discolor in southeastern Arizona (McCormick & Andresen 1963). We reaffirm this finding, but in extending the range of P. discolor into the Sierra Madre Occidental from Chihuahua through Durango to the San Miguelito Mountains of southern San Luis Potosí, we note that the dioecious tendency grows less obvious toward the southern part of the range.

Chemical analyses of wood cores collected by us of most pinyons and including P. cembroides and P. discolor have revealed striking differences in the monoterpene constituents between the latter two (analyses by E. Zavarin and K. Snajberk, pers. comm.). For P. cembroides, nine sites were sampled, 10 trees each, distributed from west Texas and northern Chihuahua south to Querétaro. For P. discolor, 12 sites were sampled, 10 trees each, distributed from southeast Arizona and southwest New Mexico, to San Luis Potosí. Pinus cembroides is high in  $\alpha$ -pinene ( $89 \pm 5\%$ ) and low in both sabinene ( $2 \pm 2\%$ ) and p-cymene ( $1 \pm 1\%$ ), whereas P. discolor is low in  $\alpha$ -pinene ( $35 \pm 10\%$ ) and high in both sabinene ( $22 \pm 14\%$ ) and p-cymene ( $12 \pm 7\%$ ). The percentages are means and standard deviations for 90 trees of P. cembroides and 120 trees of P. discolor.

In geographical regions where both P. cembroides and P. discolor occur, P. cembroides always appears first on ascending into hilly or mountainous habitats. There exists, however, a common elevational range where the two have been found growing together in Chihuahua, Durango, and San Luis Potosí. On none of these common sites is there any suggestion of hybridization between the two taxa. This may be related to a significant difference in their times of anthesis. Pinus cembroides sheds its pollen about 4 to 6 weeks earlier than P. discolor. These facts constitute a strong justification for specific rank of the two taxa.

The common name, border pinyon, is proposed for P. discolor, because its principal range lies along both sides of the international boundary between Mexico and the United States, extending about 200 km into each country. Specifically, the principal range comprises southeast Arizona, extreme southwest New Mexico, northeast Sonora, and northwest Chihuahua. P. cembroides reaches its northern limit in the Sierra Madre Occidental at about 30°N, barely reaching the southern limit of the principal range of P. discolor. Thus, the only pinyons significantly sharing the principal range of P. discolor are P. edulis var. edulis, and P. edulis var. fallax Little. Both are easily recognized and are found only in the northern portions of the principal range. The few stations presently known for P. discolor south of 30°N seem to be outliers from the main population of the border region. In Arizona and elsewhere, this tree is commonly called Mexican pinyon, a name which should be used only for Pinus cembroides. The latter is the most widely distributed pinyon in Mexico and enters the United States only in west Texas.

The recently described Pinus johannis M.-F. Robert, while lacking dorsal stomata and having fascicles mainly of 3 needles, differs conspicuously from P. discolor in growth form. It is a multi-stemmed shrub resembling Pinus culminicola Andresen & Beaman. In monoterpene chemistry, it is essentially identical with P. cembroides and P. remota and shares with them a shorter needle retention than that of P. discolor. Moreover, its geographical distribution is given as solely in the mountains just west of Concepción del Oro, Zacatecas (Robert 1978). However, pinyons with both small tree and shrub forms, with needles in fascicles mainly of 3 and lacking dorsal stomata, have been found elsewhere in some of the more important but isolated mountain ranges of Coahuila, and in the Sierra Madre Oriental farther east. Only one of these isolated populations (Sierra de la Madera, Coahuila) has thus far been tested chemically. Its monoterpene composition is identical with that of P. johannis. These populations are similar in needle anatomy to P. johannis, and different from P. discolor. For these reasons, and pending further field and laboratory studies, it is convenient to regard them as P. johannis sensu lato.

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